

**Selected papers presented at the conference on  
Membranes in Drinking and Industrial Water Production  
Paris, France, 3–6 October, 2000**



International  
Water Association



European  
Desalination Society



American Water  
Works Association



Japan Water  
Works Association

## CONTENTS

### DESALINATION VOLUME 131

An outstanding feat of modern technology: the Mery-sur-Oise Nanofiltration Treatment Plant (340,000 m <sup>3</sup> /d) <i>C. Ventresque, V. Gisclon, G. Bablon, G. Chagneau (Paris, France)</i>	1
Status after 10 years of operation — overview of UF technology today <i>J.-M. Lainé (Le Pecq, France), D. Vial (Richmond, VA, USA), P. Moulart (Rueil-Malmaison, France)</i>	17
UF/RO treatment plant Heemskerk: from challenge to full scale application <i>P.C. Kamp, J.C. Kruithof, H.C. Folmer (Velserbroek, The Netherlands)</i>	27
Design considerations for major membrane treatment facility for groundwater <i>W.B. Suratt (Ft. Lauderdale, FL, USA), D.R. Andrews (Boca Raton, FL, USA), V.J. Pujals (Ft. Lauderdale, FL, USA), S.A. Richards (Miami, FL, USA)</i>	37
Water recycling by floating media filtration and nanofiltration at a soft drink factory <i>H. Miyaki (Fujisawa, Japan), S. Adachi, K. Suda (Tokyo, Japan), Y. Kojima (Fujisawa, Japan)</i>	47
Recycling of washing waters from bottle cleaning machines using membranes <i>N. Scharnagl, U. Bunse, K.-V. Peinemann (Geesthacht, Germany)</i>	55
Water recycling using sequential membrane treatment in the electronics industry <i>M. Okazaki, M. Uraki, K. Miura, T. Nishida (Kanagawa, Japan)</i>	65
Reduction of water consumption and wastewater quantities in the food industry by water recycling using membrane processes <i>V. Mavrov, E. Bélières (Saarbrücken, Germany)</i>	75
Purification of copper wire drawing emulsion by application of UF and RO <i>K. Karakulski, W.A. Morawski (Szczecin, Poland)</i>	87
Desalination technology for optimal renovation of saline groundwater in a natural reservoir <i>A. Bick, G. Oron (Beer-Sheva, Israel)</i>	97
Using circulation tests to model natural organic matter adsorption and particle deposition by spiral-wound nanofiltration membrane elements <i>T.L. Champlin (Tampa, FL, USA)</i>	105
Simple technique for measuring the concentration polarization level in a reverse osmosis system <i>I. Sutzkover, D. Hasson, R. Semiat (Haifa, Israel)</i>	117
Improved performance of reverse osmosis with dynamic layers onto membranes in separation of concentrated salt solutions <i>T.V. Knyazkova, A.A. Kavitskaya (Kiev, Ukraine)</i>	129
Desalination in Morocco and presentation of design and operation of the Laayoune seawater reverse osmosis plant <i>H. Zidouri (Rabat, Morocco)</i>	137

Optimization of hybridized seawater desalination process .....	147
<i>M. Al-Sofi, A.M. Hassan, O.A. Hamed, A.G.I. Dalvi, M.N.M. Kither, G.M. Mustafa, K. Bamardouf (Al-Jubail, Saudi Arabia)</i>	
A demonstration plant based on the new NF-SWRO process .....	157
<i>A.M. Hassan, A.M. Farooque, A.T.M. Jamaluddin, A.S. Al-Amoudi, M.A.K. Al-Sofi, A.F. Al-Rubaian, M.N.M. Kither, I.A.R. Al-Tisan, A. Rowaili (Al-Jubail, Saudi Arabia)</i>	
Technical management of RO system .....	173
<i>Samir El-Manharawy, Azza Hafez (Cairo, Egypt)</i>	
Parameters affecting the properties of dynamic membranes formed by Zr hydroxide colloids .....	189
<i>M. Rumyantsev, A. Shauly (Haifa, Israel), S.G. Yiantsios (Thessaloniki, Greece), D. Hasson (Haifa, Israel), A.J. Karabelas (Thessaloniki, Greece), R. Semiat (Haifa, Israel)</i>	
Modified Fouling Index <sub>ultrafiltration</sub> to compare pretreatment processes of reverse osmosis feedwater .....	201
<i>Š.F.E. Boerlage, M.D. Kennedy, M.p. Aniye, E.M. Abogrean, D.E.Y. El-Hodali, Z.S. Tarawneh, J.C. Schippers (Delft, The Netherlands)</i>	
Fouling effects on rejection in the membrane filtration of natural waters .....	215
<i>A.I. Schäfer, A.G. Fane, T.D. Waite (Sydney, Australia)</i>	
The effect of shear rate on controlling the concentration polarization and membrane fouling .....	225
<i>R. Bian, K. Yamamoto (Tokyo, Japan), Y. Watanabe (Sapporo, Japan)</i>	
Comparison of the finished water quality among an integrated membrane process, conventional and other advanced treatment processes .....	237
<i>H.-H. Yeh, I.-C. Tseng, S.-J. Kao, W.-L. Lai, J.-J. Chen, G.T. Wang, S.-H. Lin (Tainan, Taiwan)</i>	
Costs of conventional versus membrane treatment for karstic spring water .....	245
<i>R. Pianta, M. Boller (Duebendorf, Switzerland), D. Urfer (Porrentruy, Switzerland), A. Chappaz, A. Gmünder (Winterthur, Switzerland)</i>	
Comparison of NF/RO membrane performance in integrated membrane systems .....	257
<i>M.M. Nederlof (Zwolle, The Netherlands), J.C. Kruithof (Bloemendaal, The Netherlands), J.S. Taylor (Orlando, FL, USA), D. van der Kooij, J.C. Schippers (Nieuwegein, The Netherlands)</i>	
Combination of membrane technology and limestone filtration to control drinking water quality .....	271
<i>R. Kettunen, P. Keskitalo (Tampere, Finland)</i>	
Electrodialysis reversal (EDR) and ion exchange as polishing treatment for perchlorate treatment .....	285
<i>V. Roquebert, S. Booth, R.S. Cushing, G. Crozes (Boise, ID, USA), E. Hansen (Magna, UT, USA)</i>	
Effect of pH on the removal of arsenic and antimony using reverse osmosis membranes .....	293
<i>M. Kang, M. Kawasaki, S. Tamada, T. Kamei, Y. Magara (Sapporo, Japan)</i>	
New composite membrane for water softening .....	299
<i>S. Bequet, T. Abenoza, P. Aptel (Toulouse, France), J.M. Espenan (Fourquevaux, France), J.-C. Remigy, A. Ricard (Toulouse, France)</i>	
Coagulation – adsorption – ultrafiltration for wastewater treatment and reuse .....	307
<i>D. Abdessemed, G. Nezzal (Algiers, Algeria), R. Ben Aim (Toulouse, France)</i>	
Pilot study on renovation of subsurface water using a reverse osmosis desalting system .....	315
<i>S. Ebrahim, Y. Al-Wazzan, M. Safar, N. Burney, A. Al-Mesri (Safat, Kuwait)</i>	
Process water production from river water by ultrafiltration and reverse osmosis .....	325
<i>M. Clever, F. Jordt, R. Knauf (Frankfurt, Germany), N. Rübiger, M. Rüdelschütz, R. Hilker-Scheibel (Bremen, Germany)</i>	
Surface water treatment with Zenon microfiltration membranes: minimisation of energy and chemical use .....	337
<i>R.B. Klijn, W.G.J. van der Meer (Leeuwarden, The Netherlands), H. Vriezen, F.H.J. van Ekkendonk (Amersfoort, The Netherlands)</i>	
Production of demineralized water out of rainwater: environmentally saving, energy efficient and cost-effective .....	345
<i>H.A. Oosterom, D.M. Koenhen, M. Bos (Dedemsvaart, The Netherlands)</i>	

Neural networks for long term prediction of fouling and backwash efficiency in ultrafiltration for drinking water production .....	353
--	-----

*N. Delgrange-Vincent, C. Cabassud, M. Cabassud (Toulouse, France), L. Durand-Bourlier, J.M. Laine (Le Pecq, France)*

## DESALINATION VOLUME 132

Biofouling potential of chemicals used for scale control in RO and NF membranes .....	1
<i>J.S. Vrouwenvelder, S.A. Manolarakis, H.R. Veenendaal, D. van der Kooij (Nieuwegein, The Netherlands)</i>	
Application of low fouling RO membrane elements for reclamation of municipal wastewater .....	11
<i>M. Wilf, S. Alt (Oceanside, CA, USA)</i>	
Flux enhancement of RO desalination processes .....	21
<i>A. Abbas, N. Al-Bastaki (Bahrain)</i>	
Effects of environment on source water for desalination plants on the eastern coast of Saudi Arabia .....	29
<i>P.K. Abdul Azis, I. Al-Tisan, M. Al-Daili, T.N. Green, A.G.I. Dalvi, M.A. Javeed (Al-Jubail, Saudi Arabia)</i>	
A design/build approach to deep aquifer membrane treatment in Southern California .....	41
<i>W.R. Everest (Newport Beach, CA, USA), S.L. Malloy (Irvine, CA, USA)</i>	
Reverse osmosis concentrate disposal in the UK .....	47
<i>D. Squire (Peterborough, UK)</i>	
Desalination of brackish fish pond effluents — pilot testing and comparative economic evaluation .....	55
of integrated UF-RO systems vs. conventional systems	
<i>P. Glueckstern, M. Priel, A. Thoma, Y. Gelman (Tel Aviv, Israel)</i>	
Direct nanofiltration or ultrafiltration of WWTP effluent? .....	65
<i>J.O.J. Duin, L.P. Wessels, H.F. van der Roest, C. Uijterlinde, H. Schoonewille (Amersfoort, The Netherlands)</i>	
Assessment of an integrated membrane systems for surface water treatment .....	73
<i>K. Glucina, H. Alvarez, J.M. Laine (Le Pecq, France)</i>	
The application of acid free antiscalant to mitigate scaling in reverse osmosis membranes .....	83
<i>A. Al-Rammah (Dhahran, Saudi Arabia)</i>	
Prevention of silica scale in membrane systems: removal of monomer and polymer silica .....	89
<i>I. Bremere, M. Kennedy, S. Mhiyo, A. Jaljuli, G.-J. Witkamp (Delft, The Netherlands), J.C. Schippers (Delft, Nieuwegein, The Netherlands)</i>	
Monitoring scaling in nanofiltration and reverse osmosis membrane systems .....	101
<i>C.A.C. van de Lisdonk (Nieuwegein, The Netherlands), J.A.M. van Paassen (Zwolle, The Netherlands), J.C. Schippers (Delft, Nieuwegein, The Netherlands)</i>	
Scaling control of RO membranes and direct treatment of surface water .....	109
<i>P.A.C. Bonné, J.A.M.H. Hofman, J.P. van der Hoek (Vogelenzang, The Netherlands)</i>	
Membrane chemical research: centuries apart .....	121
<i>E.G. Darton (Berkshire, UK)</i>	
Photochemical modification of poly(ether sulfone) and sulfonated poly(sulfone) nanofiltration membranes for control of fouling by natural organic matter .....	133
<i>J.E. Kilduff, S. Mattaraj, J.P. Pieracci, G. Belfort (Troy, NY, USA)</i>	
Seasonal variations of nanofiltration (NF) foulants: identification and control .....	143
<i>N.G. Her, G. Amy, C. Jarusuthirak (Boulder, CO, USA)</i>	
Iowa's first electrodialysis reversal water treatment plant .....	161
<i>J. Hays (Washington, IA, USA)</i>	

Recycling of water with canal water supplement at Artis Zoo, Amsterdam, by means of ultrafiltration and reverse osmosis	167
<i>C. W. Aeijselts Averink, W. Buijs (Schiedam, The Netherlands)</i>	
Biofouling in RO membrane systems. Part 1. Fundamentals and control	173
<i>M. Al-Ahmad, F.A. Abdul Aleem, A. Mutiri, A. Ubaisy (Riyadh, Saudi Arabia)</i>	
Predicting the performance of RO membranes	181
<i>N. Al-Bastaki, A. Abbas (Bahrain)</i>	
Retention of herbicides and pesticides in relation to aging of RO membranes	189
<i>P.A.C. Bonné (Vogelenzang, The Netherlands), E.F. Beerendonk (Nieuwegein, The Netherlands), J.P. van der Hoek, J.A.M.H. Hofman (Vogelenzang, The Netherlands)</i>	
Comparison of the electrodialytic properties of $\text{NiSO}_4$ and $\text{NiCl}_2$ : Influence of the salt nature in electrodialysis	195
<i>K.-E. Bouhidel (Batna, Algeria), M. Rumeau (Montpellier, France)</i>	
Concentration polarization in electrodialysis: Buffer solutions experimental method	199
<i>K.-E. Bouhidel, K. Oulmi (Batna, Algeria)</i>	
Removal of pesticides residues in water using nanofiltration process	205
<i>R. Boussahel, S. Boulard (Paris, France), K.M. Moussaoui (El Harrach, Algeria), A. Montiel (Paris, France)</i>	
Four years field experience with fouling resistant reverse osmosis membranes	211
<i>S. Coker (Freeport, TX, USA), P. Sehn (Rheinmünster, Germany)</i>	
Studies on organic foulants in the seawater feed of reverse osmosis plants of SWCC	217
<i>A.G.I. Dalvi, R. Al-Rasheed, M.A. Javeed (Al-Jubail, Saudi Arabia)</i>	
Laboratory technique for predicting the scaling propensity of RO feed waters	233
<i>A. Drak (Haifa, Israel), K. Glucina (Le Pecq, France), M. Busch, D. Hasson (Haifa, Israel), J.-M. Lainé (Le Pecq, France), R. Semiat (Haifa, Israel)</i>	
Membrane replacement in desalting facilities	243
<i>S.J. Duranceau (Orlando, FL, USA)</i>	
Use of continuous electrodeionization to reduce ammonia concentration in steam generators blowdown of PWR nuclear power plants	249
<i>C. Goffin, J.C. Calay (Linkebeek, Belgium)</i>	
Determination of membrane properties for use in the modelling of a membrane distillation module	255
<i>C.M. Gijit, I.G. Racz, T. Reith, A.B. de Haan (Enschede, The Netherlands)</i>	
Desalination of sea water using nuclear heat	263
<i>M.S. Hanra (Mumbai, India)</i>	
Modular desalting for specialized applications	269
<i>C. Harris (Yorktown, VA, USA)</i>	
Desalination of seawater: an experiment with RO membranes	275
<i>M.N.A. Hawlader, J.C. Ho, Chua Kok Teng (Singapore)</i>	
Reverse osmosis of concentrated calcium sulphate solutions in the presence of iron (III) ions using composite membranes	281
<i>A.A. Kavitskaya, T.V. Knyazkova, A.A. Maynarovich (Kiev, Ukraine)</i>	
Nanofiltration for drinking water production from deep well water	287
<i>A. Khalik (Bontang, Indonesia), V.S. Praptowidodo (Bandung, Indonesia)</i>	
Starting procedure of high-pressure pump with de-rated motor for large scale SWRO trains	293
<i>B. Liberman (Ra'anana, Israel), I. Liberman (Tel-Aviv, Israel)</i>	
Investigation on purification of hydrochloric acid by membrane method	299
<i>O.D. Linnikov, E.A. Anokhina, V.E. Scherbakov (Ekaterinburg, Russia)</i>	

Application of low-pressure nanofiltration coupled with a bicycle pump for the treatment of arsenic-contaminated groundwater .....	307
<i>J.-I. Oh, K. Yamamoto (Tokyo, Japan), H. Kitawaki (Gunma, Japan), S. Nakao, T. Sugawara (Tokyo, Japan), M.M. Rahman, M.H. Rahman (Dacca, Bangladesh)</i>	
RO and NF membrane systems for drinking water production and their maintenance techniques .....	315
<i>A.G. Pervov, E.V. Dudkin, O.A. Sidorenko, VV. Antipov, S.A. Khakhanov, R.I. Makarov (Moscow, Russia)</i>	
Studies on seawater desalination by reverse osmosis at the Badak natural gas liquefaction plant, Bontang, East Kalimantan .....	323
<i>V.S. Praptowidodo (Bandung, Indonesia), A. Khalik (Bontang, Indonesia)</i>	
First land-based plant for RO desalination in Croatia .....	329
<i>D. Sambrailo, J. Ivic (Dubrovnik, Croatia)</i>	
Performance of RO membranes in silica bearing waters .....	337
<i>R. Sheikholeslami, S. Zhou (Sydney, Australia)</i>	
Combating water shortages with innovative uses of membranes .....	345
<i>C.V. Vedavyasan (Mumbai, India)</i>	
A study of electrodeionization process — high-purity water production with a RO/EDI system .....	349
<i>J. Wang, S. Wang, M. Jin (Tianjin, China)</i>	
ETRAS thermal desalination system .....	353
<i>E.T. Ras (Tokyo, Japan), J.-J. Pomantoc (Quezon City, Philippines), E. Tumalak (Tokyo, Japan), R.T. Ras, P.R. Falar, J. Lelis (Butuan City, Philippines)</i>	





